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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 09/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/943,196

Applicant(s)

MAY, CHARLES E.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 6/27/2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,6-17 and 21-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-26 is/are allowed.
- 6) ☒ Claim(s) 1,3,7,8,12, 14, and 21-26 is/are rejected.
- 7) ☒ Claim(s) 6,9-11,13 and 15-17 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claim 6 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claim has not been further treated on the merits.

Claim Rejections – 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 3 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Koos et al. (US 5,934,980).

Koos teaches a method of planarizing a substrate by employing two separate chemical mechanical polishing (CMP) steps (column 1, lines 5-9). In step 42 (FIG. 3), a first CMP polishing solution is applied to the surface of a polishing pad to facilitate planarization of the surface **35** of substrate **12** (column 5, lines 55-59), which is followed by applying a dilution solution to the polishing pad to remove slurry of the first CMP step, and after applying the diluting solution, a second CMP solution is applied to the polishing pad to facilitate additional planarization of the substrate (Abstract). In a preferred embodiment, the first CMP mixture includes an acidic pH with alumina

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particles (which is the same as applicant's aqueous slurry containing an abrasive material), (column 5, lines 55-65).

Koos teaches a second diluting solution that is applied to the polishing surface of polishing pad **16** for cleaning residual slurry (or the first CMP step) from the polishing surface of the polishing pad **16** (column 6, lines 1-5) and rotating wafer carrier **10** and the polishing table **18** continuously during the cleaning step, to enable removal of residual slurry from the substrate **12** and polishing head **27** at the same time (column 6, lines 8-10), which suggests the polishing slurry that is applied onto the polishing pad would also be disposed onto a semiconductor wafer. Koos also teaches a diluting solution is applied to the polishing surface of polishing pad **16** for clearing the residual slurry of a first CMP step (column 6, lines 1-5) as well as a second diluting solution, which comprises a solvent, such as, deionized or alternative solvents such as acetone or alcohol, (same as applicant's nonaqueous solvent), (column 8, lines 8-14). Hence, the aforementioned reads on,

A method of fabricating a semiconductor wafer, comprising:

- (a) disposing a volume of an aqueous slurry containing an abrasive material onto a semiconductor wafer and polishing the semiconductor wafer with a polishing pad; and
- (b) disposing a volume of nonaqueous liquid including a non-aqueous solvent onto said semiconductor wafer. Since Koos uses the same method of polishing a semiconductor wafer by disposing an aqueous abrasive slurry onto the wafer with a polishing pad and disposing a dilution solution (same as applicants' nonaqueous liquid including a nonaqueous solvent) on a wafer for clearing residual slurry of the first CMP

step from the surface of the polishing pad, then using Koos' polishing method in the same manner as claimed by applicants' would inherently result to rinse the semiconductor wafer, **in claim 1**.

The said aforementioned further reads on,

said polishing pad is in contact with said semiconductor wafer when said nonaqueous solvent is disposed onto said semiconductor wafer, **in claim 3**; and

A method of fabricating a semiconductor wafer, comprising:

(a) subjecting a front side of said semiconductor wafer to chemical mechanical polishing using an aqueous slurry; and

(b) disposing a volume of a nonaqueous solvent onto said front side of said semiconductor wafer during said chemical mechanical polishing. Since Koss uses the same method of polishing a semiconductor wafer by disposing an aqueous abrasive slurry onto the wafer with a polishing pad and disposing a dilution solution (same as applicants' nonaqueous liquid including a nonaqueous solvent) on a wafer for clearing residual slurry of the first CMP step from the surface of the polishing pad, then using Koss' polishing method in the same manner as claimed by applicants' would inherently result to rinse the semiconductor wafer, **in claim 12**.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) as applied to claim 1 above, and further in view of Merchant et al. (US 6,436,830 B1).

Koos differs in failing to teach said nonaqueous solvent includes an ammine.

Merchant teaches, "The CMP slurry **10** includes a first emulsion **11** having a continuous aqueous phase (AQ_E) **12** and a second emulsion **13**. . . . The first emulsion **11** includes abrasive particles **18**. . . . The second emulsion **13** preferably comprises an organic phase (ORG) **14** and a dispersed aqueous phase (AQ_I) **16** for capturing metal particles polished from the semiconductor wafer **20**" (column 3, lines 49-60). "The organic phase **14** may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . ." (column 4, lines 12-19).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos' polishing composition by including a nonaqueous solvent such as an ammine that is taught by Merchant for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

7. Claims 8 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) as applied to claims 1 and 12 respectively above, and further in view of Zhou et al. (US 5,780,358).

Koos differs in failing to teach said nonaqueous solvent includes dimethylsulfoxide (DMSO), **in claim 8 and 14;**

Zhou teaches "Preferably, the non-aqueous coordinating solvent with the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention is chosen from the group of . . . (DMSO)" (column 8, lines 1-6). "In addition to the non-aqueous coordinating solvent, . . . the abrasive powder, various other components may optionally be included within the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention. These components include but are not limited to . . . aqueous and non-aqueous co-solvents . . . and the like as are know in the art to impart other desirable properties to the Chemical-Mechanical Polish (CMP) slurry composition of the present invention" (column 8, lines 40-49).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos' polishing slurry by including DMSO to a polishing

slurry, as taught by Zhou for the purpose of assisting in rapid dissolution of copper metal under mild conditions (column 7, lines 51-55).

8. Claims 21-26 are is rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) in view of Kobayashi (US '045)

Koos differs in failing to teach (c) mixing said aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create a first volume of an aqueous slurry/nonaqueous solvent mixture with a first weight % of said nonaqueous solvent prior to being disposed onto said semiconductor wafer.

Muroyama teaches a slurry wherein an aqueous inorganic compound of fine particles are dispersed in a nonaqueous dispersed solvent and using the slurry for polishing (Abstract and [0008]).

Since Muroyama uses an aqueous slurry and nonaqueous solvent in polishing a semiconductor film, then it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos' slurry by using Muroyama's polishing method for the purpose of using a stable polishing slurry that prevents scratching of an interlayer insulation film (see Muroyama, [0023]).

Allowable Subject Matter

9. Claims 9, 10, 11, 13, and 15-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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10. The following is a statement of reasons for the indication of allowable subject matter:

As to claims 9, 10, 11, 13, and 15-17, the prior art of record, taken either alone or in combination fails to teach or suggest obvious a method of polishing a semiconductor wafer with an aqueous slurry along with a nonaqueous solvent that includes either an ammine, N,N-propanalamide, aniline, and N,N-dimethylaniline;

Response to Arguments

11. Applicant's arguments with respect to claims 1, 3, 6-17, and 21 have been considered but are moot in view of the new ground(s) of rejection because the former prior art of record failed to address "disposing a volume of --nonaqueous liquid including-- a nonaqueous solvent onto said semiconductor --to rinse the semiconductor wafer--" as recited in base claims and 12.

Applicants traverse the 102(b) rejection of claims 1, 3, and 12 as being anticipated by Koos (US 980). Applicants argue Koos failed to teach a nonaqueous liquid solvent is used to rinse a semiconductor wafer. Since Koss' dilution solution comprises a solvent such as acetone or alcohol and a solution is defined as "a homogenous, molecular mixture of two or more substances," then Koos' dilution solution failed to meet the limitation of a nonaqueous solvent.

Applicants' argument is unpersuasive because, The transitional term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or

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method steps. See, e.g., > *Invitrogen Corp. v. Biocrest Mfg., L.P.*, 327 F.3d 1364, 1368, 66 USPQ2d 1631, 1634 (Fed. Cir. 2003) ("The transition comprising' in a method claim indicates that the claim is open-ended and allows for additional steps."); < *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501, 42 USPQ2d 1608, 1613 (Fed. Cir. 1997) ("Comprising" is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim.); *Moleculon Research Corp. v. CBS, Inc.*, 793 F.2d 1261, 229 USPQ 805 (Fed. Cir. 1986); *In re Baxter*, 656 F.2d 679, 686, 210 USPQ 795, 803 (CCPA 1981); *Ex parte Davis*, 80 USPQ 448, 450 (Bd. App. 1948) ("comprising" leaves "the claim open for the inclusion of unspecified ingredients even in major amounts"). Hence, Koos' dilution solution, which comprises acetone or alcohol, reads on a nonaqueous liquid including a nonaqueous solvent. Also, since Koss uses the same method of polishing a semiconductor wafer by disposing an aqueous abrasive slurry onto the wafer with a polishing pad and disposing a dilution solution (same as applicants' nonaqueous liquid including a nonaqueous solvent) on a wafer for clearing residual slurry of the first CMP step from the surface of the polishing pad, then using Koss' polishing method in the same manner as claimed by applicants' would inherently result to rinse the semiconductor wafer, as recited in the said claims.

Applicants traverse the 103 rejection of claims 7, 8, and 14 as being obvious over Koos (US '980) in view of additional art.

Applicants argue the lack of motivation for combining Koos (US '980) and Merchant (US '830 B1) to teach a nonaqueous solvent such as ammine, in claim 7. Applicants' argument is unpersuasive because Merchant teaches a CMP slurry that includes a first emulsion having a continuous aqueous phase and including abrasive particles and a second emulsion. The second emulsion comprises an organic phase (ORG) 14 and a dispersed aqueous phase for capturing metal particles polished from the semiconductor wafer (column 3, lines 49-60). The organic phase may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . .” (column 4, lines 12-19). Hence, the motivation for combining Koos and Merchant is for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

Applicants argue the lack of motivation for combining Koos (US '980) and Zhou (US '358) to teach a nonaqueous solvent such as DMSO, in claim 8 and 14. Applicants' argument is unpersuasive because Zhou teaches a CMP slurry composition that comprises DMSO (column 8, lines 1-6) and various other components may optionally be included within the CMP slurry composition of the present invention and include but are not limited to aqueous and non-aqueous co-solvents (column 8, lines 40-49). Hence, the motivation for combining Koos and Zhou is for the purpose of assisting in rapid dissolution of copper metal under mild conditions (Zhou, column 7, lines 51-55).

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ltue

September 6, 2005

Primary Examiner
Duy-Vu H. Do
9/6/05
jd